Chapter 1 Describing Motion

When planning a get-together with a group of friends, some of the things to consider are where you are going to meet and how you are going to get there. If it's a warm summer day, you might inline skate, cycle, ride a bus, drive a car, or walk to your destination. Which would you prefer?

For many people, the mode of travel is as much a decision about exercise and a healthy lifestyle as it is about getting there on time. If you've been inactive and indoors all day, it feels great to have the wind in your hair and to be out exercising in the fresh air. For most people, healthy choices extend beyond choosing inline skating to deciding to wear a helmet and other protective equipment.

Some might say that it would be much easier to simply hop in a car and drive wherever you want to go. But even this option involves making many choices in terms of safety. The driver must first ensure that everyone has buckled up; then the driver has to make dozens of decisions in terms of speed, merging into traffic, entering intersections when the green light has just changed to yellow . . . the list goes on. At the heart of all these decisions is the physics of motion.

By the end of this chapter you will be able to describe motion in terms of displacement, time, velocity, and acceleration. You will be able to explain these terms by referring to Newton's laws of motion and apply them to transportation and transportation safety.

Try This Activity

Reaction Time

Concentration is essential when driving an automobile. Distractions can affect a driver's reaction time—the time it takes the driver to respond to the changes around him or her. The inability to react quickly can cause collisions.

Purpose

You will determine your reaction time under different circumstances.

Materials

- metre-stick
- cellphone
- calculator

Note: A calculator may be used in place of a cellphone.

Procedure

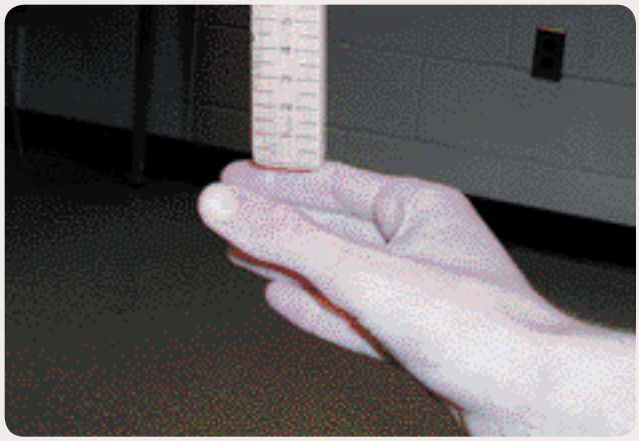

Figure B1.1: Your thumb and forefinger should be about 3 cm apart.

step 1: Sit beside a desk or table so that your arm is resting on the tabletop and your wrist extends over the edge (as shown in Figure B1.1).

step 2: Have your partner hold a metre-stick so that the end of the metre-stick is even with the tops of your thumb and forefinger (which are separated by about 3 cm).

step 3: Once you say you are ready, your partner will release the metre-stick within the next 20 seconds. As soon as you notice the metre-stick falling, try to catch it between your thumb and forefinger.

step 4: Record how many centimetres the metre-stick fell before you caught it.

step 5: Repeat steps 1 to 4 three times, and determine the average distance the metre-stick fell.

step 6: Calculate your reaction time using the following formula as a guide:

$$\Delta t = \sqrt{\frac{2\Delta d}{a}}$$, where Δt = time (in seconds)

Δd = distance (in metres)

a = gravitational acceleration ($9.81\ m/s^2$)

step 7: Trade places with your partner, and repeat steps 1 to 6.

step 8: A cellphone is a common distraction for drivers. Hold a cellphone (or calculator) in your hand that is not resting on the table (as shown in Figure B1.2).

step 9: Repeat steps 1 to 7 to simulate the effect a cellphone has on reaction time. As soon as you are ready for your partner to drop the metre-stick, begin entering your home telephone number into the cellphone.

Figure B1.2: Reaction time is tested while simulating using a cellphone.

Analysis

1. Did reaction times change when you were entering the telephone number?
2. Can you think of another driver distraction that would affect reaction time that could be tested here? If so, try it.